THURSDAY, OCTOBER 31, 1912

THEORIES OF SOLUTIONS.

Theories of Solutions. By Svante Arrhenius. Pp. xx+247. (New Haven: Yale University Press; London: Oxford University Press, 1912.) Price 12*s.* 6*d.* net.

THE publication of Prof. Arrhenius's Silliman lectures on "Theories of Solutions," delivered at Yale in the spring of 1911, will be welcomed by all who are interested in the present position of physical chemistry. The book is of special value because the author has dealt very lightly with those aspects of his theory of "electrolytic dissociation" which have been discussed over and over again during the last twenty-five years and have occupied so large a space in nearly all recent text-books of physical chemistry. Thus, although many of his illustrations are drawn from electrolytic solutions, only three of the eleven lectures deal specifically with such solutions, namely, those on "The Theory of Electrolytic Dissociation," "Conductivity of Strong Electrolytes," and "Abnormality of Strong Electrolytes."

A special feature of the lectures is the historical method of treatment, which is adopted, not only in the first lecture, on "The History of the Theory of Solutions," but throughout the whole course. The author is, indeed, anxious to demonstrate that the newer views of the nature of solutions were a natural and logical development from those that had been in vogue previously, and seeks to disclaim the ide that he and his co-workers in this field originated a revolution which was in any sense a complete break with the past

The most fascinating lecture of the series is that on "The Modern Molecular Theory." To the average chemist it will be a complete revelation to know how accurately the actual masses of the molecules have been determined in recent years. These masses are recorded most conveniently by determining the magnitude of the constant N, the number of molecules in a gram-molecule, which is, naturally, the same for all molecules. Three methods used by Perrin and based upon the behaviour of minute suspended particles gave for N the values 68×10^{22}, 65×10^{22} and 71×10^{22}; three methods based upon the study of radioactive substances, including, for instance, the actual counting of α-particles, have given the figures 62×10^{22}, 71×10^{22} and 71×10^{22}. Other methods have given 71×10^{22}, 62×10^{22} and 62×10^{22}. It is indeed remarkable that nine series of determinations should agree thus together, the extreme range being only ± 6 per cent.

Other topics dealt with are "Suspension," "Adsorption," "Velocity of Reaction," "Equilibria in Solutions," and "The Doctrine of Energy." In the introduction, the author expresses the view that modern physical chemistry is largely synonymous with "theoretical chemistry," one of its chief functions being to express in mathematical form the experimental measurements of physicists and chemists; that he himself has not lost his skill in this art is shown by the introduction of some new formulæ in the present volume; that even more far-reaching results may flow from this method of working is clear from the use which has been made by Perrin, Lindemann and others of the formulæ developed within the last five years by Einstein.

It is a matter for regret that a book of small dimensions should have been issued at so prohibitive a price as to confine it very largely to reference libraries. The trustees of the "Silliman Foundation" would fulfil the purposes of the trust with much greater efficiency if they could arrange to circulate the printed lectures on more reasonable terms to a much larger circle of readers.

T. M. L.

INTRODUCTIONS TO BIOLOGICAL STUDY.

(1) *A Guide for the Study of Animals.* By Worrallo Whitney, Frederic C. Lucas, Harold B. Shinn, and Mabel E. Smallwood. Pp. ix+197. (Boston, New York, Chicago: D. C. Heath and Co.) Price 2*s.*

(2) *College Zoology.* By Prof. Robert W. Hegner. Pp. xxv+733. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 11*s.* net.

(3) *Einführung in die Biologie.* By Prof. Karl Kraepelin. Dritte, verbesserte Auflage. Pp. viii+356. (Leipzig and Berlin: B. G. Teubner, 1912.) Price 4.80 marks.

(1) THE teaching of biology is much more widely spread amongst American than among British schools, and the need for systematised courses of instruction in natural history is there greater than with us. In this work compiled by science teachers of Chicago high schools a graduated course of zoological teaching is drawn up, beginning with observations on house-flies and ending with some very good suggestions on the use of domestic breeds of animals as object lessons. So far as this suggested course goes, the book may be of considerable help to teachers in search of a suitable curriculum. The greater part of the work is, however, devoted to lists of questions that any good teacher could draw up without assistance. Some of the questions are badly worded or unanswerable; for example, "Compared with a hydra, how many cells has an earthworm?"

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We have some difficulty in judging adequately of this book, since sixteen pages have been left out in binding up the review copy.

(2) For the most part Dr. Hegner's book runs on the familiar lines of comparative anatomy, and his treatment of the structure of animal phyla does not differ essentially from that adopted in any of the recent text-books of zoology, to which, indeed, he is indebted for most of his subject-matter and illustrations. The feature that he claims to be distinctive in this work is the consideration of animal physiology alongside of animal structure. The difficulty has been to compress a treatment of two such large subjects into the compass of a handy volume. Comparative physiology is in itself a large and new subject and would easily require a whole volume of this size. The author has cut the knot by reducing both anatomy and physiology to a condensed form that can scarcely be assimilated by any student. The physiological paragraphs deal mainly with responses to simple forms of stimulation—the behaviour of Paramecium and of Hydra are excellent examples of this—but they do not attempt to show the evolution of physiology amongst animals as do the sections upon anatomy.

Some useful sections are devoted to showing the economic bearing of zoological knowledge. The statement of the food of birds is a good instance of this, though here, again, the need for brief summaries has precluded the insertion of much interesting matter. The remarks on the damage due to insects, for example, are too brief to be of much value.

Compression has been carried too far in the case of invertebrates of uncertain affinities in chapter ix. Either these groups should have been omitted or treated more fully. On the whole the chapter on insects strikes one as being the best in the work, and the treatment of the affinities of animal phyla as the least satisfactory feature of it. The use of the terms "efferent" and "afferent" in connection with the circulation of the crayfish, on p. 283, is the converse of general usage and may lead to considerable confusion. The illustrations are very good and clear; those of the honey-bee, though not original, are sure to be welcome. Fig. 369 is turned upside down. Perhaps the greatest appeal of this very carefully compiled work will be to those who wish to have a book on comparative anatomy in one volume.

(3) This work, by the director of the Natural History Museum at Hamburg, has run into three editions in less than six years, and its success is due to the clear and well-balanced treatment that it contains of both branches of biology. In the present edition the sections on comparative anatomy and on the early races of mankind have been expanded and brought up to date so as to make an exceptionally attractive and very cheap work. Dealing, as the book does, mainly with general problems, it seems rather a pity that the statement of Mendel's method is not clearly given. The essence of the method and its importance can be stated quite simply without going into details. The account that is given here, printed, as it is, in minute type and dealing with a single case, will no doubt be expanded or altered in the next edition.

PHYSICS: OLD AND NEW.

(1) *Junior Magnetism and Electricity.* By Dr. R. H. Jude and Dr. J. Satterly. Pp. vii + 288. (London: W. B. Clive, University Tutorial Press, Ltd., 1912.) Price 2*s.* 6*d.*

(2) *An Introduction to Practical Physics for Colleges and Schools.* By Prof. E. H. Barton and Dr. T. P. Black. Pp. vii + 188; illustrated. (London: Edward Arnold, 1912.) Price 3*s.* 6*d.*

(3) *Mémoires sur l'Electricité et l'Optique.* By A Potier. Publiés et Annotés par A. Blondel. Avec une Préface de Henri Poincaré. Pp. xx + 330. (Paris: Gauthier-Villars, 1912.) Price 13 francs.

(4) *Treatise on Light.* In which are explained the causes of that which occurs in Reflexion, and in Refraction, and particularly in the strange Refraction of Iceland Crystal. By Christiaan Huygens. Rendered into English by Silvanus P. Thompson. Pp. xii + 129. (London: Macmillan and Co., Ltd., 1912.) Price 10*s.* net.

(5) *Intermediate Physics.* By Prof. W. Watson, F.R.S. Pp. xiii + 564. With diagrams. (London: Longmans, Green and Co., 1912.) Price 6*s.* net.

(6) *Lehrbuch der Physik.* By Prof. Eduard Riecke. Erster Band. Mechanik, Molekularerscheinungen und Akustik. Optik. Zweiter Band. Magnetismus und Elektrizität. Wärme. Fünfte, verbesserte und vermehrte Auflage. Pp. xvi + 600 + xii + 775; illustrated. (Leipzig: Veit and Co., 1912.) Price 26 marks. 2 Vols.

(7) *Physik in graphischen Darstellungen.* By Felix Auerbach. Pp. x + 28 + 213 plates. (Leipzig and Berlin: B. G. Teubner, 1912.) Price 9 marks.

(1) SO many elementary text-books of this kind appear from time to time (one of the present authors is already responsible for two) that it is very difficult to judge whether or not a new publication possesses advantages over its predecessors. The scope of the subject is so limited that all of them are bound to be very much alike, and in any one book there can only be a

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